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A REVIEWPAPER ON NANOTECHNOLOGY BASED METHODS FOR IMPROVING ORAL BIOAVAILABILITY

RenukaJyothi.S
Assistant professor,Department of LifeSciences,
School ofSciences, B-II, Jain(Deemed to beUniversity), Bangalore-560027, India.
Email Id:j.renuka@jainuniversity.ac.in

Abstract

Oral administration, since it provides high patient enforcement, is the most convenient path between different drug distribution paths. However, in effective oral drug delivery, low aqueous solubility and poor enzymatic/metabolic stability of drugs are major constraints. There are many approaches to improving the hydrophobic drug issue. Among the different methods, the drug delivery method focused on nanotechnology has the potential to solve the problems associated with the oral route of administration.In many areas of medicine, there are innovative drug delivery systems available. In the management of hypertension, the use of these devices continues to broaden. In order to enhance the solubility profile, dissolution, and consequently the bioavailability of hydrophobic antihypertensive drugs, the present review focuses on the different nano carriers available in oral drug administration. The most popular, simple, and widely used route of administration is oral drug delivery as it offers benefits such as painless administration, no aid, and patient compliance compared to other routes such as intramuscular, intravenous, and pulmonary.

Keywords: *Bioavailability,Drug, Oral, Patient, Poor.*

I. INTRODUCTION

In order to exhibit therapeutic action, medications with low oral bioavailability are unable to achieve the minimum effective concentration. Some of the reasons for poor bioavailability are as follows: (a) one of the reasons is poor solubility of drugs that affect bioavailability as drugs should be present at the absorption site in solution form; (b) another is inadequate

partition coefficient as it affects drug permeation via lipid membrane; (c) first-pass metabolism induces drug metabolism resulting in poor absorption[1].

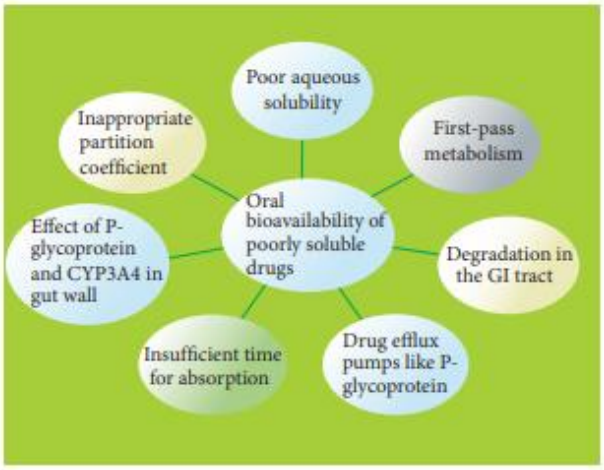

Figure 1: Depicts the schematic diagram of oral bioavailability[2].

Table 1:Summary of some of investigations on nano systems of antihypertensive drugs[3].

Name of drug	Colloidal system	Application
Carvedilol	Solid lipid nanoparticles	Enhanced bioavailability and protecting it from acidic environment
	Nanosuspensions	Increased oral bioavailability
	Carbon nanotubes	Drug loading capacity and improving the solubility
	Mesoporous silica nanoparticles	Improvement in drug loading and drug release profile
Nebivolol	Polymeric nanoparticles	Prolonged drug release
Valsartan	Solid lipid nanoparticles	Bypassing first-pass metabolism, enhancing lymphatic absorption, and improving solubility and bioavailability
	Nanosuspensions	Enhanced drug release
	Self-nanoemulsifying drug delivery system	Increase in dissolution rate
	Polymeric nanoparticles	Prolonged release of drug and thereby it decreases its dose size, frequency of dose, and side effects
	Proliposomes	Good flowability and particle size distribution and well conversion into liposomes by hydration and desirable *in vitro* drug release
Felodipine	Nanosuspensions	Enhanced solubility and oral bioavailability
	Polymeric nanoparticles	Controllable drug release and effective *in vitro* compatibility
Nifedipine	Dendrimers	Enhanced water solubility
	Polymeric nanoparticles	Improved oral bioavailability
	Nanocrystals	Enhanced dissolution rate
Candesartan cilexetil	Dendrimers	Improved water solubility
	Nanosuspension	Improved bioavailability
	Polymeric micelles	Increased drug loading capacity and drug release
Nitrendipine	Solid lipid nanoparticles	Enhanced bioavailability
	Nanoemulsion	Improved therapeutic efficacy and bioavailability
	Nanocrystals	Improvement in physical stability, *in vitro* drug release, and bioavailability

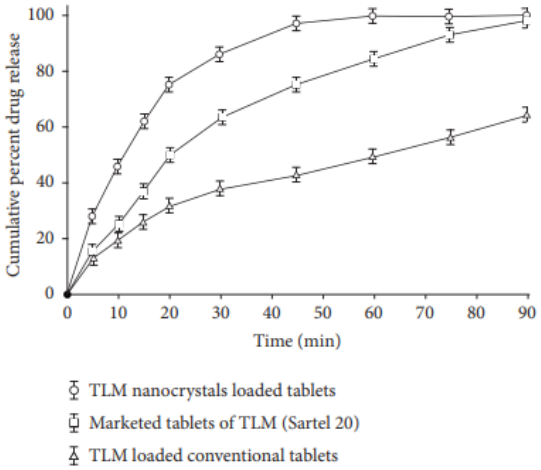

Figure 2: Illustrates comparison of in vitro drug release profiles of Telmisartan(TLM)[4].

To improve therapeutic effectiveness and sustained drug release properties while addressing problems such as poor solubility and low oral bioavailability of antihypertensive products, novel drug delivery systems have been increasingly explored at present. The available antihypertensive pharmaceutical products are grouped into the following categories: ACE inhibitors, calcium channel blockers, angiotensin antagonists, core sympathomimetic agents, diuretics, alpha-adrenergic blockers, beta-adrenergic blockers, and vasodilators[5].

II. DISCUSSION

Drugs with weak solubility have trouble formulating by applying traditional methods since they present problems such as slow onset of action, poor oral bioavailability, lack of proportionality of the dosage, inability to achieve plasma concentration in the steady state, and undesirable side effects[6]. Therefore, traditional dosage forms can result in over- or under-medication and poor compliance with patients[7]. These challenges can be overcome by applying novel drug delivery systems that offer benefits like reduction in dose frequency, lowering of dose size, site specific targeting, enhanced permeability, and improvement in oral bioavailability[8].

In the production of drug delivery systems, nanotechnology is a promising technique, in particular for those potent drugs whose clinical development has failed due to their poor solubility, low permeability, insufficient bioavailability and other poor biopharmaceutical properties[9].

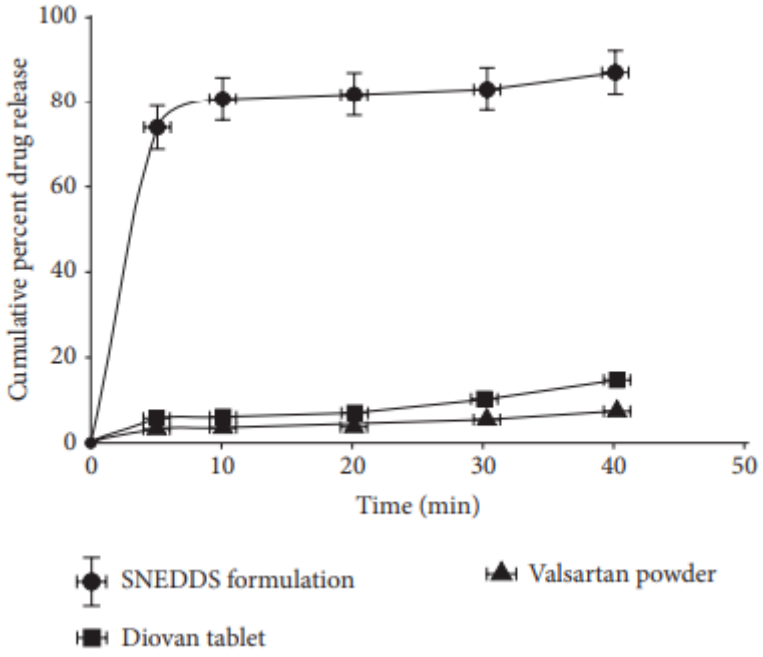

Figure 3: Illustrates the assessment of in vitro drug release profile of SNEDDS comprising valsartan powder with valsartan tablet[10]**.**

Figure 1 depicts the schematic diagram of oral bioavailability.Figure 2 illustrates the comparison of in vitro drug release profiles of Telmisartan (TLM). Figure 3 illustrates the assessment of in vitro drug release profile of SNEDDS comprising valsartan powder with valsartan tablet. Table 1 summary of some of the investigations on nano systems of antihypertensive drugs.

III. CONCLUSION

By enhancing solubility and oral bioavailability, nanotechnology holds tremendous promise for the efficient delivery of poorly soluble antihypertensive drugs. In addition, innovative approaches to drug delivery have emerged as methods for revitalizing the creation of new hydrophobic entities. Some important advantages of nano systems are biocompatibility, colloidal size, drug targeting, lowered dosage size, decreased toxicity, and patient compliance.Literature survey shows different advantages of the new drug delivery system, some of the benefits include improved targeting, bioavailability, therapeutic efficacy, and scalability of production provided by solid lipid nanoparticles, while SNEDDS provides an enhanced interfacial area for drug partitioning and improved bioavailability and does not require high-energy emulsification. Moreover, for both active and passive targeting, polymeric nanoparticles provide ease of manipulation of particle size and surface characteristics. Because of their unusual properties, such as strongly branched structure, multi-valence, and flexible chemical compositions, dendrimers have gained interest.

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Proliposomes contain free-flowing granular content that increases solubility, stability and ease of handling

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